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MANUFACTURE OF CONNECTING ROD

Patent Number: JP10128481
Publication date: 1998-05-19
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Applicant(s): HONDA MOTOR CO LTD
Requested Patent: JP10128481
Application Number: JP19960284383 19961025
Priority Number (s):
IPC Classification: B21D53/84; F16C7/02
EC Classification:
Equivalents:

Abstract

PROBLEM TO BE SOLVED: To form a rugged part in a mating surface by integrally casting a cast iron connecting rod, irradiating a laser beam on the left and right central part in the inside of a large end part, applying a force in the expanding direction and dividing the large end part into two.
SOLUTION: The cast iron connecting rod stock integrally formed a small end part, a rod part and the large end part is cast. The left and right central part in the inside of the large end part are irradiated with the laser beam, and a notch is formed along the thickness direction. The irradiated part becomes a cementite structure, which is hard and brittle. Sectional pieces are set within the large end part, a taper member is inserted into sectional pieces, and impact force is applied. A crack is generated in the large end part making the notch a starting point, the connecting rod stock is divided into a semi-annular part 3 and a cap part 5. The broken section becomes the mating surface of the semi-annular part 4 and the cap part 5. Irregular rugged part 6, 7 fitting each other are formed in the mating surface. The left and right are never mistaken at the time of assembling.

(19)日本国特許庁（ＪＰ）　(12)公開特許公報（A）　(11)特許出願公開番号

特開平10－128481

(43)公開日　平成10年(1998)５月19日

(51)Int.Cl.[6]	識別記号	FI	
B21D 53/84		B21D 53/84	A
F16C 7/02		F16C 7/02	
// B21K 1/14		B21K 1/14	

審査請求　未請求　請求項の数４　ＯＬ　（全５頁）

(21)出願番号　特願平8－284383

(22)出願日　平成８年(1996)10月25日

11/24 記

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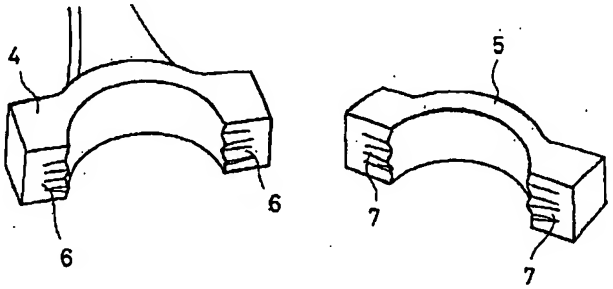
最終頁に続く

(54)【発明の名称】　コネクティングロッドの製造方法

(57)【要約】

【課題】　コネクティングロッドの本体側の半環状部とキャップとの合せ面に互いに嵌合する凹凸部を簡単に形成する。

【解決手段】　鋳鉄製コネクティングロッド素材Ｗを傾斜台１０の上にセットし、レーザ光照射装置１１の先端を大端部３内に臨ませ、レーザ光照射装置１１から大端部内側のセンター部にレーザ光（ＹＡＧレーザ）を照射しつつレーザ光照射装置１１を移動せしめることで、大端部内側の左右のセンター部に厚み方向に沿ってノッチ１２，１２を形成する。この後、大端部に拡開方向の衝撃力を加え、大端部３を半円環状部とキャップに破断する。破断面は半円環状部とキャップの合せ面になるが、それぞれの合せ面には互いに嵌合する不規則な凹凸部が形成されている。



【特許請求の範囲】

【請求項１】　鋳造によって、小端部、ロッド部及び大端部が一体となった鋳鉄製コネクティングロッド素材を成形し、このコネクティングロッド素材の大端部内側の左右のセンター部にレーザ光を照射してコネクティングロッド素材の厚さ方向にノッチを形成し、次いで大端部に拡開方向の力を加えることで、前記ノッチを起点として径方向にクラックを発生させて大端部を２つに破断するようにしたことを特徴とするコネクティングロッドの製造方法。

【請求項２】　請求項１に記載のコネクティングロッドの製造方法において、前記大端部内側の左右のセンター部に形成される少なくとも一方のノッチの形状を、大端部内側から見て千鳥状をなすようにしたことを特徴とするコネクティングロッドの製造方法。

【請求項３】　請求項１に記載のコネクティングロッドの製造方法において、前記大端部内側の左右のセンター部に形成されるノッチの大端部内側から見た形状を異ならせるようにしたことを特徴とするコネクティングロッドの製造方法。

【請求項４】　請求項１に記載のコネクティングロッドの製造方法において、前記大端部内側の左右のセンター部に対するレーザ光の照射角度を異ならせるようにしたことを特徴とするコネクティングロッドの製造方法。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明はコネクティングロッドの製造方法のうち、特に大端部を構成する本体側の半環状部とキャップとの合せ面に特徴を持たせた製造方法に関する。

【０００２】

【従来の技術】エンジンを構成するコネクティングロッドはピストンに連結される小端部と、クランクシャフトに連結される大端部とこれらをつなぐロッド部からなり、大端部は更に本体側の半環状部とキャップとに分割され、これら本体側の半環状部とキャップとを突き合せて形成される円環部でクランクシャフトを抱持するようにしている。

【０００３】そして、上記本体側の半環状部とキャップとの合せ面が完全な平面であると、本体側の半環状部にキャップを組み付けた後に、振動等によってズレが生じ、一箇所に応力が集中しやすい。また、合せ面が完全な平面であると、組み付け時に位置決めが難しく、更には左右を取り違えて組み付ける所謂誤組みが発生する虞れがある。そこで従来にあっては本体側の半環状部とキャップの一方にピンを他方にこのピンが嵌合する穴を形成している。

【０００４】上記ピンを用いて位置決めする構造では、部品点数が多くなると共に工程数も増えてしまう。そこで、コネクティングロッド本体側の半環状部とキャップとの突き合せ面に互いに嵌合する凹凸部を形成する手段が、特開平７－７１４３８号公報、特開平７－１００５７６号公報及び米国特許第３，９９４，０５４号公報に提案されている。

【０００５】特開平７－７１４３８号公報に開示される内容は、コネクティングロッド本体のプリフォームとキャップのプリフォームとを合せ面を対向させた状態で金型内にセットし、これら２つのプリフォームを同時に鍛造することで、鍛造中の材料流れにより合せ面に互いに嵌合する凹凸部を形成するようにしている。

【０００６】特開平７－１００５７６号公報に開示される内容は、コネクティングロッド本体となる素材とキャップとなる素材とを、互いに嵌合する凹凸部を合せ面に有するように別々に異形押出しにより成形し、これら素材をコネクティングロッドの厚さに切断し、次いでコネクティングロッド本体とキャップとを合せた状態で鍛造するようにしている。

【０００７】米国特許第３，９９４，０５４号公報に開示される内容は、鍛造によって、小端部、ロッド部及び大端部が一体となったコネクティングロッドを成形し、更に大端部左右のセンター部に厚さ方向に貫通するＶ型ノッチを有するクラック穴を形成し、このクラック穴にテーパーピンを差し込んで衝撃を与えることで大端部を２つに破断するようにしている、

【０００８】

【発明が解決しようとする課題】特開平７－７１４３８号公報に開示される手段では、コネクティングロッド本体のプリフォームとキャップのプリフォームとを別々に製造しなければず、また、鍛造用の金型へのセットも手間がかかる。特開平７－１００５７６号公報に開示される手段では、前記同様コネクティングロッド本体とキャップとを別々に製造しなければならず、更に異形押出しに所定厚さに切断する工程が余分に必要になる。また、米国特許第３，９９４，０５４号公報に開示される手段では、合せ面に互いに嵌合する凹凸が必ず形成されるとは限らず、位置ズレや誤組みが発生する虞れがあり、更に鍛造品であるのでクラッキング穴周辺の靭性が高く、キャップを破断する際の変形量が大きい。

【０００９】

【課題を解決するための手段】上記課題を解決すべく本発明に係るコネクティングロッドの製造方法は、小端部、ロッド部及び大端部が一体となった鋳鉄製コネクティングロッド素材を鋳造によって成形し、このコネクティングロッド素材の大端部内側の左右のセンター部にレーザ光を照射してコネクティングロッド素材の厚さ方向にノッチ（スリット等の凹部を含む）を形成し、次いで大端部に拡開方向の力を加えることで、前記ノッチを起点として径方向にクラックを発生させて大端部を２分割するようにした。

【００１０】レーザ光を照射することで、照射された部

分の組織がパーライト組織からセメンタイト組織に変わる。このセメンタイト組織は硬く且つ脆いので、大端部に拡開方向の力を加えると、表面がセメンタイト組織のノッチを起点として径方向にクラックが簡単に発生し、大きな変形を伴うことなく大端部をコネクティングロッド本体側の半環状部からキャップを破断することができる。

【００１１】そして、上記破断によって形成される合せ面には、互いに嵌合する不規則な凹凸が形成されるので、組付け時の位置決めが容易になり、誤組みが防止され、更に組付け後のズレも防止できる。

【００１２】上記の位置決めを容易にし、誤組みを防止し、更に組付け後のズレを防止する更なる有効な手段は、大端部内側の左右のセンター部に形成される少なくとも一方のノッチの形状を、大端部内側から見て千鳥状をなすようにするか、大端部内側の左右のセンター部に形成されるノッチの大端部内側から見た形状を異ならせるか、或いは、大端部内側の左右のセンター部に対するレーザ光の照射角度を異ならせることが考えられる。

【００１３】尚、鋳鉄製コネクティングロッド素材に対しては大端部内側面に真円加工を施す必要がある。この真円加工を行った後に破断する場合には、ノッチの深さを真円加工の削代よりも大きくしておく。

【００１４】

【発明の実施の形態】以下に本発明の実施の形態を添付図面に基づいて説明する。図１は本発明方法によって製造したコネクティングロッドの全体図であり、コネクティングロッドはピストンに連結する小端部１、ロッド部２及びクランクシャフトを抱持する大端部３から構成され、大端部３はコネクティングロッド本体側の半円環状部４とこの半円環状部４にボルトにより取り付けられるキャップ５に分けられ、これら半円環状部４とキャップ５の合せ面６，７は不規則な凹凸部で互いに嵌合している。

【００１５】次に、上記のコネクティングロッドを製造する工程を、図２～図４に基づいて説明する。先ず、小端部、ロッド部及び大端部が一体となった鋳鉄製コネクティングロッド素材を鋳造する。そして、図２に示すように、この鋳鉄製コネクティングロッド素材Ｗを傾斜台１０の上にセットし、レーザ光照射装置１１の先端を大端部３内に臨ませ、レーザ光照射装置１１から大端部内側のセンター部にレーザ光（ＹＡＧレーザ）を照射しつつレーザ光照射装置１１を移動せしめることで、大端部内側のセンター部に厚み方向に沿ってノッチ１２を形成する。

【００１６】そして、同様にして左右のセンター部にノッチ１２を形成したならば、図３に示すように、大端部３内に一対の割駒１３，１３をセットし、これら割駒１３，１３間に上方からテーパー部材１４を差し入れ、更にテーパー部材１４に上方から衝撃を加える。

【００１７】その結果、大端部３には左右のノッチ１２を起点として、径方向外側に向かってクラックが走り、大端部３は半円環状部４とキャップ５に分割される。また、この場合、破断面が半円環状部４とキャップ５の合せ面６，７になるが、図４に示すようにそれぞれの合せ面には互いに嵌合する不規則な凹凸部が形成されている。そして、これら凹凸部はキャップ５の左右を入れ替えた場合、半円環状部４との合せ面に形成されている凹凸部と嵌合しなくなるので、組付け時に左右を間違えることがない。

【００１８】図５及び図６は大端部内側に形成するノッチ形状の別実施例を示す図であり、前記実施例にあっては左右のノッチとも千鳥状（折れ線）状としたが、図５に示すように一方のセンター部に形成するノッチ１２のみを千鳥状（折れ線）状とし、他方を直線状にするか、或いは図６に示すように左右のノッチ１２のいずれも直線とするが、レーザ光の照射角度を左右において異ならせ、ノッチの大端部内側面に対する形成角を左右において異ならせるようにしてもよい。要は、大端部を破断した場合に、合せ面となる左右の破断面にそれぞれ異なる凹凸部が形成されればよい。

【００１９】

【発明の効果】以上に説明したように本発明に係るコネクティングロッドの製造方法によれば、小端部、ロッド部及び大端部が一体となった鋳鉄製コネクティングロッド素材を鋳造によって成形し、このコネクティングロッド素材の大端部内側の左右のセンター部にレーザ光を照射してコネクティングロッド素材の厚さ方向に硬く脆いセメンタイト組織のノッチを形成したので、大端部に拡開方向の力を加えることで、該ノッチを起点として径方向にクラックを進展させ、大端部を簡単に且つ変形を抑制しつつ破断することができる。

【００２０】因みに、図７（ａ）はレーザ光によって形成したノッチの金属組織を示す顕微鏡写真、（ｂ）は（ａ）に基づいて作成した図、図８（ａ）はワイヤーカットによって形成したノッチの金属組織を示す顕微鏡写真、（ｂ）は（ａ）に基づいて作成した図であり、これらの写真及び図から明らかなように、従来のワイヤカットによる場合には金属組織（パーライト組織）に変化は見られないが、レーザ光による場合には、ノッチ表層部とノッチの先端からかなり深い箇所までがセメンタイト組織に変化してることが分る。

【００２１】セメンタイト組織は硬く且つ脆いため応力が加わると破断しやすい。したがって、図７に示すように、ノッチの先端からかなり深い箇所までセメンタイト組織に変化してると、クラックの走る方向もある程度決ってくる。したがって、ノッチの形成角度によって破断面のおよその形状も定めるので、レーザ光の照射角度を変化させることで、破断面形状をコントロールすることもできる。

【００２２】また、上記破断によって形成される合せ面には、互いに嵌合する凹凸が形成されるので、組付け時の位置決めが容易になり、誤組みが防止され、組付け後のズレも防止できる。

【図面の簡単な説明】

【図１】本発明方法によって製造したコネクティングロッドの全体図

【図２】コネクティングロッドの大端部内側にレーザ光を照射している状態を示す図

【図３】コネクティングロッドの大端部を破断している状態を示す図

【図４】破断後の合せ面を示す斜視図

【図５】大端部内側に形成するノッチ形状の別実施例を示す図

【図６】大端部内側に形成するノッチ形状の別実施例を示す図

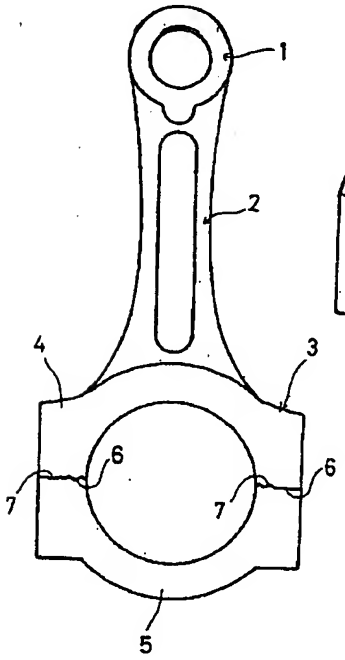
【図７】（ａ）はレーザ光によって形成したノッチの金属組織を示す顕微鏡写真、（ｂ）は（ａ）に基づいて作成した図

【図８】（ａ）はワイヤーカットによって形成したノッチの金属組織を示す顕微鏡写真、（ｂ）は（ａ）に基づいて作成した図

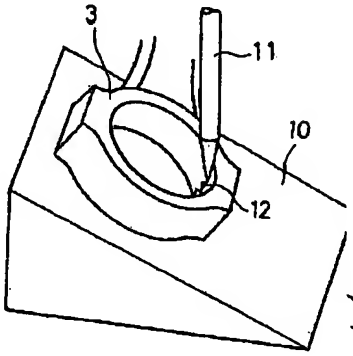
【符号の説明】

１…小端部、２…ロッド部、３…大端部、４…半円環状部、５…キャップ、６，７…合せ面、１１…レーザ光照射装置、１２…ノッチ、Ｗ…鋳鉄製コネクティングロッド素材。

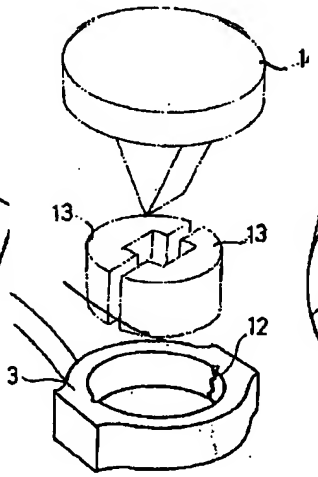
【図１】



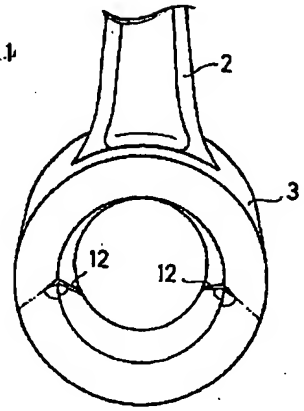
【図２】



【図３】



【図６】



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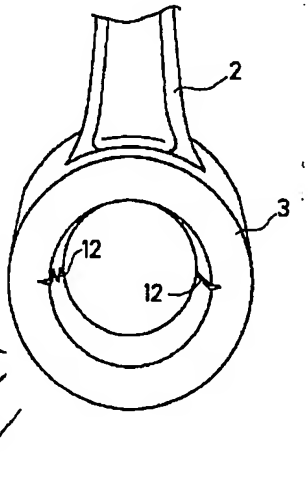

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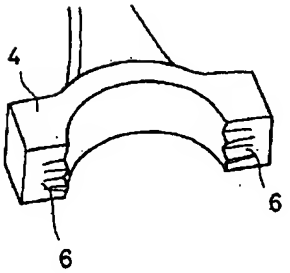

【図７】

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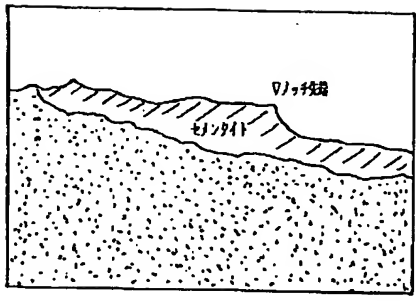
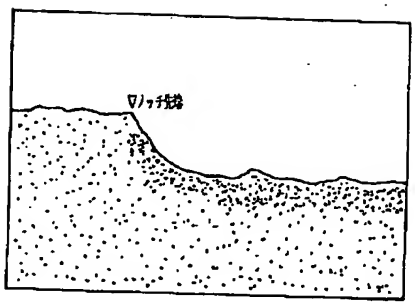


(b)

【図８】

(a)



(b)

フロントページの続き

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CLAIMS

[Claim(s)]
[Claim 1] By casting, the connecting rod material made of cast iron with which a small edge, the rod section, and a large end were united is fabricated. By irradiating a laser beam at the pin center,large section of right and left inside [large end] this connecting rod material, forming a notch in the thickness direction of a connecting rod material, and subsequently to a large end applying the force of the extension direction The manufacture approach of the connecting rod characterized by generating a crack in the direction of a path with said notch as the starting point, and fracturing a large end to two.
[Claim 2] The manufacture approach of the connecting rod characterized by seeing the configuration of one [which is formed in the pin center,large section of right and left of said large end inside / at least] notch from the large end inside in the manufacture approach of a connecting rod according to claim 1, and making the shape of alternate.
[Claim 3] The manufacture approach of the connecting rod characterized by making it change the configuration seen in the manufacture approach of a connecting rod according to claim 1 from the large end inside of the notch formed in the pin center,large section of right and left of said large end inside.
[Claim 4] The manufacture approach of the connecting rod characterized by making it change whenever [illuminating-angle / of the laser beam to the pin center,large section of right and left of said large end inside] in the manufacture approach of a connecting rod according to claim 1.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] Especially this invention relates to the manufacture approach which gave the description to the mating face of the half-annular section by the side of the body which constitutes a large end among the manufacture approaches of a connecting rod, and a cap.
[0002]
[Description of the Prior Art] The connecting rod which constitutes an engine consists of the rod section which connects the small edge connected with a piston, the large end connected with a crankshaft, and these, and a large end is further divided into the half-annular section by the side of a body, and a cap, and he is trying to support a crankshaft from under in the circular ring section which compares the half-annular section by the side of these bodies, and a cap, and is formed.
[0003] And after the mating face of the half-annular section by the side of the above-mentioned body and a cap attaches a cap to the half-annular section by the side of a body as it is a perfect flat surface, gap arises and it is easy to concentrate stress by vibration etc. on one place. Moreover, positioning is difficult in a mating face being a perfect flat surface at the time of attachment, and there is a possibility that the so-called incorrect **** which mistakes and attaches right and left further may occur. Then, if it is in the former, the hole into which this pin fits a pin on another side is formed in the half-annular section by the side of a body, and one side of a cap.
[0004] With the structure positioned using the above-mentioned pin, while components mark increase, a routing counter will also increase. then, the half-annular section by the side of the body of a connecting rod and a cap -- compare -- a means to form the concave heights which fit into a field mutually is proposed by JP,7-71438,A, JP,7-100576,A, and the U.S. Pat. No. 3,994,054 official report.
[0005] The contents indicated by JP,7-71438,A set preforming of the body of a connecting rod, and preforming of a cap in metal mold in the condition of having made the mating face countering, and he is trying to form the concave heights which fit into a mating face mutually by the ingredient flow under forging by forging these two preforming into coincidence.
[0006] The contents indicated by JP,7-100576,A are separately fabricated by variant extrusion so that it may have the concave heights which fit in mutually the material used as the material used as the body of a connecting rod, and a cap in a mating face, and they cut these materials in the thickness of a connecting rod, and he is trying to forge, where the body of a connecting rod and a cap are subsequently set.
[0007] The contents indicated by the U.S. Pat. No. 3,994,054 official report are [0008] he is trying to fracture a large end to two by fabricating the connecting rod with which a small edge, the rod section, and a large end were united, forming the crack hole which has the V type notch further penetrated in the thickness direction in the pin center,large section of large end right and left, inserting a taper pin in this crack hole, and giving an impact with forging.
[Problem(s) to be Solved by the Invention] With the means indicated by JP,7-71438,A, if preforming of the body of a connecting rod and preforming of a cap are not manufactured separately, the set to ** and the metal mold for forging also requires time and effort. With the means indicated by JP,7-100576,A, similarly, the body of a connecting rod and a cap must be manufactured separately, and said process cut in predetermined thickness carrying out profile extrusion further is too much needed. Moreover, it does not restrict that the irregularity which fits into a mating face mutually with the means indicated by the U.S. Pat. No. 3,994,054 official report is surely formed, but there is a possibility that

location gap and incorrect **** may occur, since it is a forging further, the toughness around a cracking hole is high, and the deformation at the time of fracturing a cap is large.
[0009]
[Means for Solving the Problem] The manufacture approach of the connecting rod applied to this invention that the above-mentioned technical problem should be solved The connecting rod material made of cast iron with which a small edge, the rod section, and a large end were united is fabricated by casting. By irradiating a laser beam at the pin center,large section of right and left inside [large end] this connecting rod material, forming a notch (crevices, such as a slit, being included) in the thickness direction of a connecting rod material, and subsequently to a large end applying the force of the extension direction A crack is generated in the direction of a path with said notch as the starting point, and the large end was divided into two.
[0010] By irradiating a laser beam, the organization of the irradiated part changes to a cementite organization from a pearlite organization. Since it is firmly weak, this cementite organization can fracture a cap for a large end from the half-annular section by the side of the body of a connecting rod, without a crack's occurring simply and accompanying a front face in the direction of a path by big deformation with the notch of a cementite organization as the starting point, if the force of the extension direction is applied to a large end.
[0011] And since the irregular irregularity which fits in mutually is formed in the mating face formed of the above-mentioned fracture, positioning at the time of attachment becomes easy, incorrect **** is prevented, and the gap after assembly can also be prevented further.
[0012] Further effective means to make the above-mentioned positioning easy, to prevent incorrect ****, and to prevent the gap after assembly further The configuration of one [which is formed in the pin center,large section of right and left of the large end inside / at least] notch It is possible to change the configuration which looked at from the large end inside and was seen from the large end inside of the notch which makes the shape of alternate or is formed in the pin center,large section of right and left of the large end inside, or to change whenever [illuminating-angle / of the laser beam to the pin center,large section of right and left of the large end inside].
[0013] In addition, it is necessary to perform perfect circle processing to a large end medial surface to the connecting rod material made of cast iron. In fracturing after performing this perfect circle processing, it makes it larger than the machining allowance of perfect circle processing of the depth of a notch.
[0014]
[Embodiment of the Invention] The gestalt of operation of this invention is explained based on an accompanying drawing below. Drawing 1 is the general drawing of a connecting rod which manufactured by this invention approach. A connecting rod consists of large ends 3 which support from under the small edge 1, the rod section 2, and the crankshaft which are connected with a piston. The large end 3 was divided into the cap 5 attached in the semicircle annular section 4 and this semicircle annular section 4 by the side of the body of a connecting rod with a bolt, and the mating faces 6 and 7 of the these semicircle annular section 4 and cap 5 have fitted in mutually by irregular concave heights.
[0015] Next, the process which manufactures the above-mentioned connecting rod is explained based on drawing 2 - drawing 4 . First, the connecting rod material made of cast iron with which a small edge, the rod section, and a large end were united is cast. And a notch 12 is formed in the pin center,large section of the large end inside along the thickness direction by making laser beam irradiation equipment 11 move, setting this connecting rod material W made of cast iron on a tilting table 10, making the tip of laser beam irradiation equipment 11 overlook in a large end 3, and irradiating a laser beam (YAG laser) from laser beam irradiation equipment 11 at the pin center,large section of the large end inside, as shown in drawing 2 .
[0016] And if a notch 12 is similarly formed in the pin center,large section on either side, as shown in drawing 3 , **** 13 and 13 of a pair will be set in a large end 3, the taper member 14 will be inserted from the upper part between these **** 13 and 13, and an impact will be further added to the taper member 14 from the upper part.
[0017] Consequently, a crack runs to a large end 3 toward the direction outside of a path with the notch [as the starting point] 12 on either side, and a large end 3 is divided into the semicircle annular section 4 and cap 5. Moreover, although the fracture surface turns into the mating faces 6 and 7 of the semicircle annular section 4 and cap 5 in this case, as shown in drawing 4 , the irregular concave heights which fit in mutually are formed in each mating face. And since these concave heights stop fitting in with the concave heights currently formed in the mating face with the semicircle annular section 4 when right and left of cap 5 are replaced, right and left are not mistaken at the time of

attachment.
[0018] Although drawing 5 and drawing 6 were drawings showing another example of the notch configuration formed in the large end inside, and they considered as the shape of alternate (polygonal line) also with the notch on either side if they were in said example Although all of the notch 12 on either side are made into a straight line as only the notch 12 formed in the pin center,large section is made into the shape of alternate (polygonal line) as while shows drawing 5 , another side is made into the shape of a straight line or it is shown in drawing 6 Whenever [illuminating-angle / of a laser beam] is changed in right and left, and you may make it change the formation angle over the large end medial surface of a notch in right and left. In short, when a large end is fractured, concave heights different, respectively should just be formed in the fracture surface on either side used as a mating face.
[0019]
[Effect of the Invention] According to the manufacture approach of the connecting rod applied to this invention as explained above The connecting rod material made of cast iron with which a small edge, the rod section, and a large end were united is fabricated by casting. Since the laser beam was irradiated at the pin center,large section of right and left inside [large end] this connecting rod material and the notch of a hard weak cementite organization was formed in the thickness direction of a connecting rod material By applying the force of the extension direction to a large end, a crack is developed in the direction of a path with this notch as the starting point, and it can fracture, controlling deformation simply [large end].
[0020] The microphotography in which the metal texture of the notch which formed drawing 7 (a) by the laser beam is incidentally shown, (b) the microphotography in which the metal texture of the notch which formed drawing created based on (a) and drawing 8 (a) by wire cut is shown, and (b) so that clearly [it may be drawing created based on (a) and] from these photographs and drawing When based on the conventional wire cut, change is not looked at by the metal texture (pearlite organization), but when based on a laser beam, it turns out that from the tip of the notch surface section and a notch to the quite deep part is changing to the cementite organization.
[0021] Since [hard and] it is weak, if stress is added, it will be easy to fracture a cementite organization. Therefore, if it is changing to the cementite organization from the tip of a notch to a quite deep part as shown in drawing 7 , the direction which a crack runs will also be decided to some extent. Therefore, since the near configuration of the fracture surface is also defined with the formation include angle of a notch, a fracture surface configuration is also controllable by changing whenever [illuminating-angle / of a laser beam].
[0022] Moreover, since the irregularity which fits in mutually is formed in the mating face formed of the above-mentioned fracture, positioning at the time of attachment becomes easy, incorrect **** is prevented, and the gap after assembly can also be prevented.

[Translation done.]

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TECHNICAL FIELD

[Field of the Invention] Especially this invention relates to the manufacture approach which gave the description to the mating face of the half-annular section by the side of the body which constitutes a large end among the manufacture approaches of a connecting rod, and a cap.

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PRIOR ART

[Description of the Prior Art] The connecting rod which constitutes an engine consists of the rod section which connects the small edge connected with a piston, the large end connected with a crankshaft, and these, and a large end is further divided into the half-annular section by the side of a body, and a cap, and he is trying to support a crankshaft from under in the circular ring section which compares the half-annular section by the side of these bodies, and a cap, and is formed.

[0003] And after the mating face of the half-annular section by the side of the above-mentioned body and a cap attaches a cap to the half-annular section by the side of a body as it is a perfect flat surface, gap arises and it is easy to concentrate stress by vibration etc. on one place. Moreover, positioning is difficult in a mating face being a perfect flat surface at the time of attachment, and there is a possibility that the so-called incorrect **** which mistakes and attaches right and left further may occur. Then, if it is in the former, the hole into which this pin fits a pin on another side is formed in the half-annular section by the side of a body, and one side of a cap.

[0004] With the structure positioned using the above-mentioned pin, while components mark increase, a routing counter will also increase. then, the half-annular section by the side of the body of a connecting rod and a cap -- compare -- a means to form the concave heights which fit into a field mutually is proposed by JP,7-71438,A, JP,7-100576,A, and the U.S. Pat. No. 3,994,054 official report.

[0005] The contents indicated by JP,7-71438,A set preforming of the body of a connecting rod, and preforming of a cap in metal mold in the condition of having made the mating face countering, and he is trying to form the concave heights which fit into a mating face mutually by the ingredient flow under forging by forging these two preforming into coincidence.

[0006] The contents indicated by JP,7-100576,A are separately fabricated by variant extrusion so that it may have the concave heights which fit in mutually the material used as the material used as the body of a connecting rod, and a cap in a mating face, and they cut these materials in the thickness of a connecting rod, and he is trying to forge, where the body of a connecting rod and a cap are subsequently set.

[0007] He is trying for the contents indicated by the U.S. Pat. No. 3,994,054 official report to fracture a large end to two by fabricating the connecting rod with which a small edge, the rod section, and a large end were united, forming the crack hole which has the V type notch further penetrated in the thickness direction in the pin center,large section of large end right and left, inserting a taper pin in this crack hole, and giving an impact with forging.

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EFFECT OF THE INVENTION

[Effect of the Invention] According to the manufacture approach of the connecting rod applied to this invention as explained above The connecting rod material made of cast iron with which a small edge, the rod section, and a large end were united is fabricated by casting. Since the laser beam was irradiated at the pin center,large section of right and left inside [large end] this connecting rod material and the notch of a hard weak cementite organization was formed in the thickness direction of a connecting rod material By applying the force of the extension direction to a large end, a crack is developed in the direction of a path with this notch as the starting point, and it can fracture, controlling deformation simply [large end].
[0020] The microphotography in which the metal texture of the notch which formed drawing 7 (a) by the laser beam is incidentally shown, (b) the microphotography in which the metal texture of the notch which formed drawing created based on (a) and drawing 8 (a) by wire cut is shown, and (b) so that clearly [it may be drawing created based on (a) and] from these photographs and drawing When based on the conventional wire cut, change is not looked at by the metal texture (pearlite organization), but when based on a laser beam, it turns out that from the tip of the notch surface section and a notch to the quite deep part is changing to the cementite organization.
[0021] Since [hard and] it is weak, if stress is added, it will be easy to fracture a cementite organization. Therefore, if it is changing to the cementite organization from the tip of a notch to a quite deep part as shown in drawing 7 , the direction which a crack runs will also be decided to some extent. Therefore, since the near configuration of the fracture surface is also defined with the formation include angle of a notch, a fracture surface configuration is also controllable by changing whenever [illuminating-angle / of a laser beam].
[0022] Moreover, since the irregularity which fits in mutually is formed in the mating face formed of the above-mentioned fracture, positioning at the time of attachment becomes easy, incorrect **** is prevented, and the gap after assembly can also be prevented.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] With the means indicated by JP,7-71438,A, if preforming of the body of a connecting rod and preforming of a cap are not manufactured separately, the set to ** and the metal mold for forging also requires time and effort. With the means indicated by JP,7-100576,A, similarly, the body of a connecting rod and a cap must be manufactured separately, and said process cut in predetermined thickness carrying out profile extrusion further is too much needed. Moreover, it does not restrict that the irregularity which fits into a mating face mutually with the means indicated by the U.S. Pat. No. 3,994,054 official report is surely formed, but there is a possibility that location gap and incorrect **** may occur, since it is a forging further, the toughness around a cracking hole is high, and the deformation at the time of fracturing a cap is large.

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MEANS

[Means for Solving the Problem] The manufacture approach of the connecting rod applied to this invention that the above-mentioned technical problem should be solved The connecting rod material made of cast iron with which a small edge, the rod section, and a large end were united is fabricated by casting. By irradiating a laser beam at the pin center,large section of right and left inside [large end] this connecting rod material, forming a notch (crevices, such as a slit, being included) in the thickness direction of a connecting rod material, and subsequently to a large end applying the force of the extension direction A crack is generated in the direction of a path with said notch as the starting point, and the large end was divided into two.
[0010] By irradiating a laser beam, the organization of the irradiated part changes to a cementite organization from a pearlite organization. Since it is firmly weak, this cementite organization can fracture a cap for a large end from the half-annular section by the side of the body of a connecting rod, without a crack's occurring simply and accompanying a front face in the direction of a path by big deformation with the notch of a cementite organization as the starting point, if the force of the extension direction is applied to a large end.
[0011] And since the irregular irregularity which fits in mutually is formed in the mating face formed of the above-mentioned fracture, positioning at the time of attachment becomes easy, incorrect **** is prevented, and the gap after assembly can also be prevented further.
[0012] Further effective means to make the above-mentioned positioning easy, to prevent incorrect ****, and to prevent the gap after assembly further The configuration of one [which is formed in the pin center,large section of right and left of the large end inside / at least] notch

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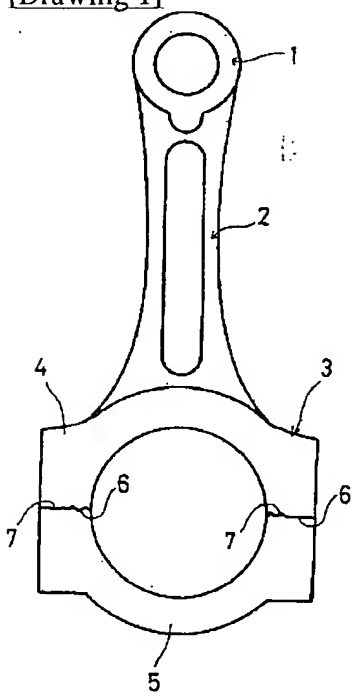
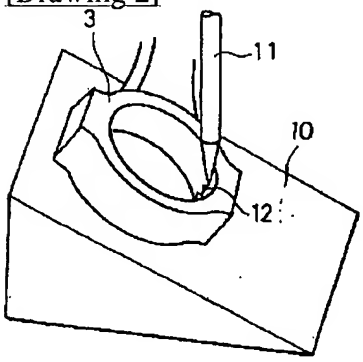
DRAWINGS

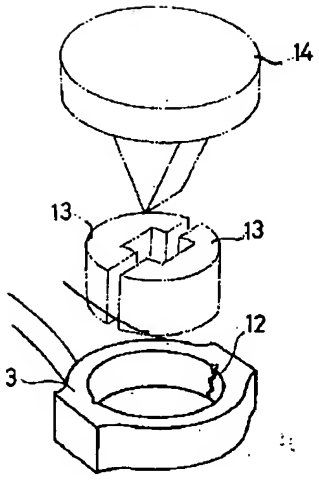
[Drawing 1]



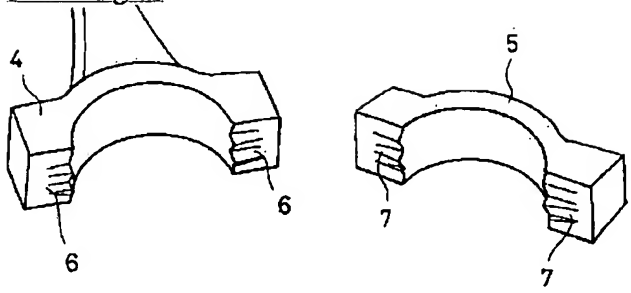
[Drawing 2]



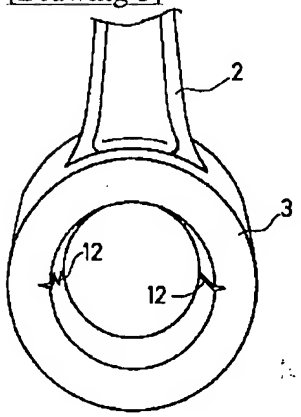
[Drawing 3]



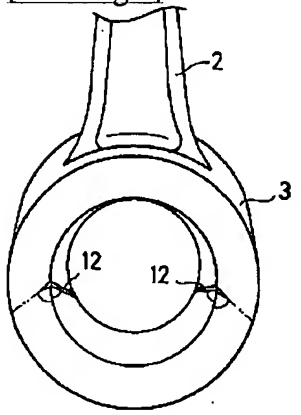
[Drawing 4]



[Drawing 5]

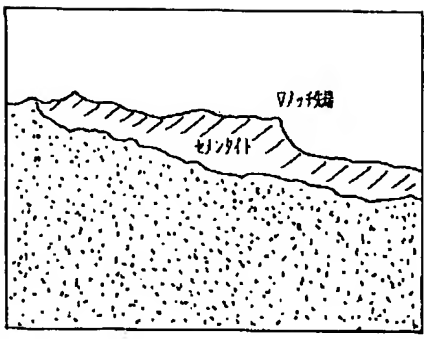


[Drawing 6]



[Drawing 7]

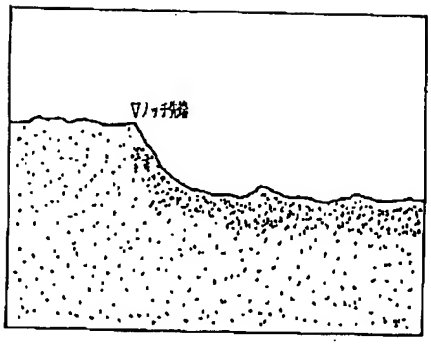
(a)



(b)

[Drawing 8]

(a)



(b)

[Translation done.]